

AO CONNECTIONS

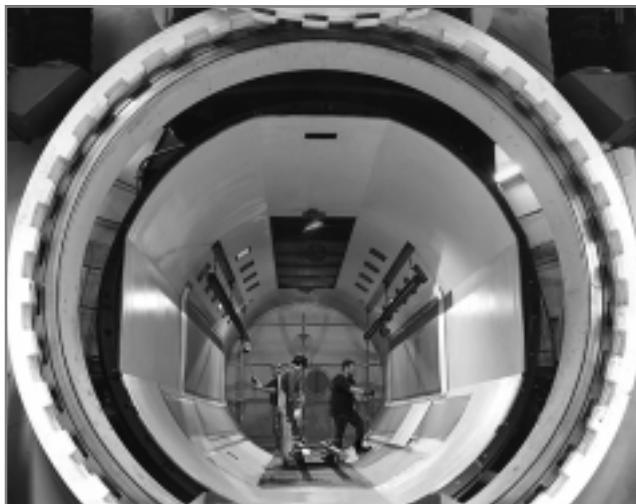
October 10, 1997

Information for the NASA Ames Aeronautical Test & Simulation Community



\$35 Million Project To Improve NASA Wind Tunnels

by Dave Engelbert



Work crew prepares to install new rails to support the image plane in the 12 Ft. Test Section, as part of the ADTE project.

Some of you may have noticed an unusual silence during the last few weeks as you walked past the 12-Ft. Pressure Wind Tunnel (PWT), on the way to the Ames Cafeteria for lunch. You may have wondered what was going on - or not going on - in the 12 Ft. PWT. In fact, the tunnel has been shutdown since the end of August, while wind tunnel improvements are installed as part of the ADTE program.

ADTE (Aeronautics Design and Test Environment) is a \$35 million program intended to improve wind tunnel testing - 'making the aircraft design process faster, better, and cheaper,' according to Mike George, ADTE program manager at Ames.

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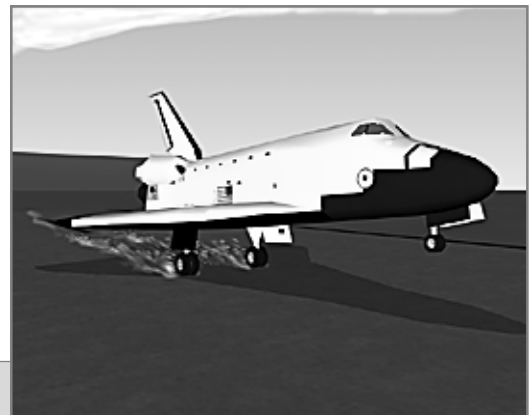
Orbiter Simulation Uses VLab

by Chris Sweeney

The second Space Shuttle Orbiter simulation test of 1997 was recently completed on the Vertical Motion Simulator (VMS). This simulation studied the issues of forward center of gravity (c.g.) expansion certification, extended nose gear struts, visibility flight rules, tire failure flight rules, close in aim point versus large speedbrake angle landings, Virtual Lab (VLab) familiarization and use, and crew training.

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Space Shuttle Orbiter landing simulation.



Inside....

- **Tiltrotors go to the Netherlands**
- **Landing the 747 with Aural Height Cues**
- **Ambitious LRTA/NFAC Program**
- **HSCT and Flight in the Year 2006**

TRAM: Countdown to DNW (Duits-Nederlandse-Windkanaal)

by Larry A. Young

Wind tunnel teams (and in particular rotorcraft project teams) are a dedicated, hard working bunch of people. Each person on the project team contributes to the success of the project; each person counts on teammates to hold up their end of the project. Rotorcraft project teams forge ahead through years of effort to accomplish their goals. In a Valley that is used to project cycles of six months or less, it is hard to explain to our families and neighbors the level of determination, tenacity, and long-term foresight required to perform our jobs.

Two Critical Milestones Reached

This past August and September, the Tilt Rotor Aeroacoustic Model (TRAM) project has at long last reached two critical milestones. Seven years from its inception, the first major set of full-

span TRAM hardware was delivered to NASA Ames, and the isolated rotor TRAM test stand completed the critical functional testing required to go to Duits-Nederlandse-Windkanaal (the DNW wind tunnel in The Netherlands).

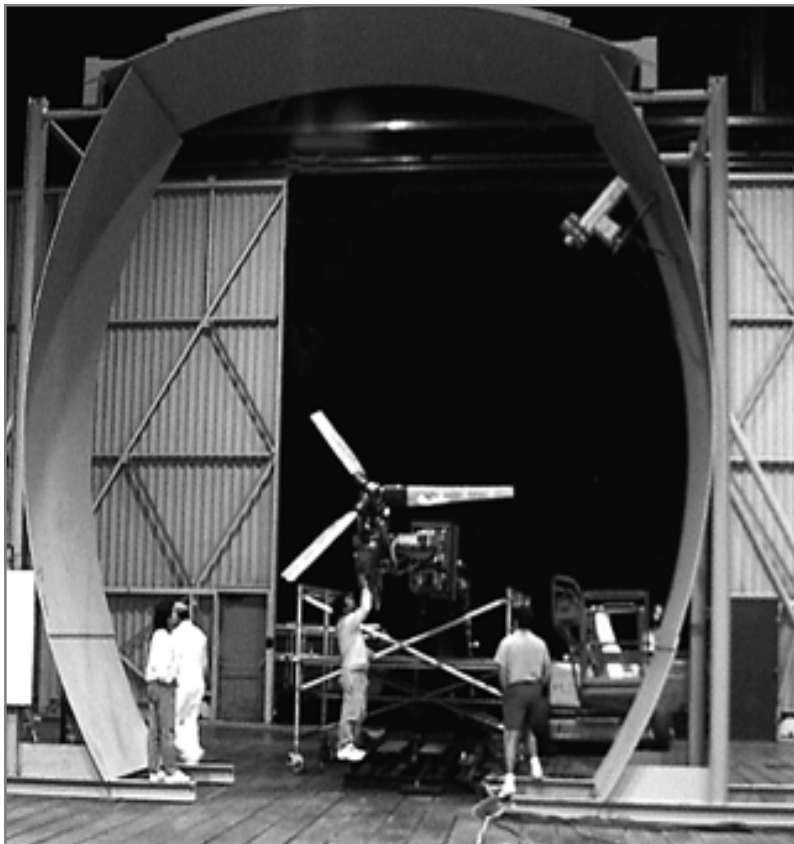
In Building 221, in the 40- by 80- low-bay/annex area, a hardware staging area has been prepared for the first set of TRAM full-span model hardware. This first set of hardware arrived August 4. The full-span TRAM is a complete 1/4-scale representation of the V-22 Osprey tiltrotor aircraft. The full-span TRAM will be tested in the NFAC 40- by 80- in June 1999. In FY98 a substantial amount of model build-up and functional testing of the full-span TRAM will occur in Building 246 (once the TRAM isolated rotor configuration ships out). The full-span TRAM activity will be concurrent with the DNW isolated rotor tests.

Meanwhile, in Building 246, the isolated rotor TRAM test stand performed blades-on hover/functional testing from August 14 to September 9. The test team is now concentrating on final check-out/troubleshooting of software and instrumentation issues that do not require blades-on hover runs. Rotor performance, structural loads, and blade airloads were acquired during the hover testing. The TRAM airloads data will provide unique insights into tiltrotor prop rotor aerodynamics and acoustics. The TRAM isolated rotor hover/functional test data is, in part, being validated/verified through correlation with data from a 1984 Outdoor Aerodynamic Research Facility (OARF) 0.658-scale V-22 prop rotor hover test. (As a 'new' Deputy Test Director during the '84 OARF test and now the TRAM Project Manager, the author can attest to having weird feelings of déjà vu when seeing cross-plots of the two data sets.)

Why the Netherlands?

The TRAM isolated rotor team has finished the final countdown for its work over in Building 246 and will be shipping out the model and control room equipment to the DNW wind tunnel any day now. Test team thoughts of troubleshooting are now turning to ones of travel plans. A sizable Code AR/AO contingent will be at the DNW this coming FY for testing in December and April. It must seem strange to most people reading this article to find out that a team of NASA and U.S. Army personnel will be traveling to The Netherlands to acquire tiltrotor airloads and acoustic data. After all, why go to the DNW when Ames Research Center has several of the World's premier aeronautical research facilities? However, even though the National Full-scale Aerodynamics Complex is 'home' to most members of the TRAM team, the U.S. Army/NASA rotorcraft research community actually has had a long-standing relationship with the DNW. Several outstanding small-scale rotor aeroacoustic research programs have been conducted at the DNW. But never fear, several full-span TRAM tests are planned in the 40-by 80-Foot Wind Tunnel when it comes back on-line after the Acoustic Modification Project.

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Isolated Rotor TRAM in Building 246.

747 Aural Alerting Study

by **Barry Sullivan**

CVSRF staff recently completed experiment runs on the 747-400 Simulator in support of the Aural Alerting Study. This study was conducted by the Human Information Processing Research Branch (AFH) in the Flight Management & Human Factors Division, in conjunction with researchers from McDonnell-Douglas. The purpose of this study was to quantitatively determine the handling qualities effects of the aural height cue during landing operations. Correlation of results from previous large airplane handling qualities investigations exposed different touchdown performance and handling qualities ratings for similar aircraft types. It was therefore hypothesized that the presence of the aural height cue during one of the studies significantly improved touchdown landing performance and handling qualities ratings. This study was conducted in support of work completed on the Vertical Motion Simulator a few years ago in support of the High Speed Research (HSR) Program.



The 747-400 Simulator was used to conduct a series of offset approaches and landings. Subject pilots were asked to fly down a laterally offset glideslope until a predetermined altitude (about 250 ft.) At this predetermined altitude, the pilots were instructed to maneuver the airplane to land on the runway at a predetermined landing zone, with and without the help of the aural height cue. Flight conditions were conducted during day, night and dusk scenes for runway 30 at Long Beach Airport. To make the approaches more challenging, updrafts were inserted into the simulations through the 747-400 Simulator's "Microburst" model, which was modified for this experiment. Approaches were also configured for landings at both light and heavy weight conditions. In addition, the aural height cue was modified for this test to say "50, 40, 30, 20, 10" as opposed to "50, 30, 10", which is the normal 747-400 aural height cue during landing operations. Test pilots from NASA Ames, NASA Dryden, McDonnell-Douglas and the US Air Force participated in this study.

High Speed Civil Transport (HSCT)

by **Chris Sweeney**

The High Speed Research (HSR) program is a collaborative effort between NASA and the U.S. Aerospace Industry. The goal of this effort is to develop the high leverage technologies necessary for an environmentally acceptable, economically viable, high speed civil transport (HSCT), providing three hundred passengers Mach 2.4 intercontinental service beginning in the year 2006. In support of this goal, the HSR program's Guidance and Flight Controls team conducts a series of simulations and flight tests designed to validate guidelines and methods to meet the flying qualities and certification criteria for an HSCT development program. The HSR program conducted a VMS simulation from 14 July through 14 August with a test plan divided into two parts.

Part one of the test plan studied flight envelope protection, HUD symbology, and some early vertical guidance algorithms. Pilots thought the envelope protection (annunciation and flight control system intervention when limits were exceeded) was

appropriate for the aircraft, and could have been more aggressive in preventing the pilot from exceeding structural limits. The investigation into HUD symbology was to study the effects of landing guidance and different mechanizations of the flight path symbol. All of the pilots preferred the landing guidance, and gave differing opinions on the preferred flight path symbol. Vertical guidance profiles - for descent to approach and climb after takeoff in autopilot - were shown to a few pilots. The pilots who were shown the profiles thought they were reasonable, and were a possible method to climb to and descend from cruise.

Part two of the test plan was to develop and refine lateral flying qualities criteria for an HSCT type of aircraft, specifically the roll control effectiveness criterion. Also evaluated was the lateral-directional characteristics of the current model. The investigation into the lateral flying qualities

criteria involved displaying to the pilot different roll rate capabilities to find the Level 1, Level 2, and Level 3 break in handling qualities. The lateral-direction characteristics were shown to the pilots with roll hold mode on and off. The pilots unanimously preferred the hold mode on.

The simulation was completed with 556 data runs collected for part one of the test plan and 907 data runs for part two of the test plan. Eight pilots from Ames, Boeing, and the FAA participated in the simulation.

HSCT pilot's eye view.



Large Rotor Test Apparatus (LRTA) Research in NFAC

by Tom Norman

Three large rotor research programs have been approved for testing in the National Full-Scale Aerodynamic Complex (NFAC) within the next three years. The first program requires testing of a pressure-instrumented UH-60A rotor in the 40- by 80-Foot Wind Tunnel in support of the UH-60 Airloads Program (model-scale wind tunnel test, full-scale wind tunnel test, flight test). Data from this test will be compared with model-scale data to assess scaling effects, and with flight data to assess wind tunnel and flight-test similarities/differences. In addition, the test program will investigate rotor performance, dynamics and loads beyond the UH-60A flight envelope.

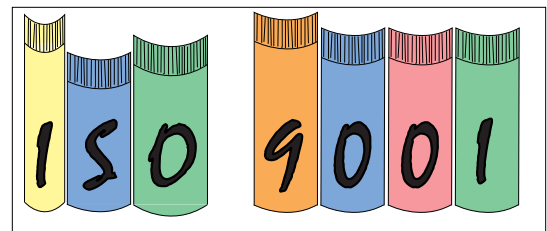
The second program, designated RADICL, is a joint NASA, Army, Sikorsky, and German effort. The objective of this program is to demonstrate the potential military/commercial benefit of integrated controls technology through development and application of Individual Blade Control (IBC) technology to an advanced UH-60 rotor system. A 40- by 80- test has been proposed as one part of this complete program, which also includes significant analysis efforts and flight testing. To reduce costs and increase efficiency, the UH-60 Airloads and RADICL programs will be combined into a single 40- by 80- entry, currently scheduled for February, 2000.

The third program is a joint effort with Boeing Helicopters, Mesa (formally McDonnell Douglas Helicopters) and DARPA. The primary objective of the DT-2000 program is to evaluate the capabilities of a new advanced Apache rotor system and compare them with the current AH-64A design. The plan calls for a hover and low speed wind tunnel test of the DT-2000 rotor system in the 80- by 120-Ft Wind Tunnel followed by high speed testing in the 40- by 80-Ft Wind Tunnel.

The primary objectives of the 80- by 120- test are: substantiating rotor system integrity, evaluating stability and performance in hover, and determining low-speed forward flight characteristics. The primary objective of the 40- by 80- test is to determine high-speed forward flight characteristics, especially dynamic loads and deflections. After completion of the DT-2000 testing in the 40- by 80-, an AH-64A rotor will be installed and tested to provide baseline data for comparison and for correlation with rotor analysis methodology. Both the 80- by 120- and 40- by 80- tests are scheduled for the year 2000.

One common requirement of these test programs is the use of the Large Rotor Test Apparatus (LRTA). The

(Continued on page 5)



AO Internal Audits Underway

by Sally Brew

To assess whether AO's quality system meets the ISO standards, internal audits are now underway in the division. A team of auditors in the division have been trained in a two-day class. Between now and the end of the year, these auditors in teams of two will audit individuals selected within their functional area to be audited.

The purpose of the *internal* audits is to help everyone in AO to prepare for the pre-assessment and final audits, which will be conducted by *external* auditors next year. The internal audits give everyone in AO the opportunity to really know whether they are ISO compliant in their procedures, documentation, and records.

The division is fortunate that eighteen individuals are willing to take time out of busy schedules to go through the training and to conduct audits. The following employees from throughout the division will conduct the internal audits: Michele Charpentier, Jason Brown, Mark McGlaughlin, Dave Denbow, Debbi Ballinger, Rob Fong, Sally Brew, Joseph Huang, Ron Johnson, Al Lizak, Paul Chaplin, Tobias Giles, John Thiele, Tony Ogden, Steve Ord, Scott Smith, Lynton Kypta, and David Chin.

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The LRTA (shown here in Building 246) is a wind tunnel test stand designed for testing moderate-to-large helicopter and tiltrotors.

TRAM - Countdown to DNW

(Continued from page 2)

The TRAM team is very excited about the progress that has been recently made after all the hard work invested by everybody. If you see someone smiling around Building 221 or 246 nowadays, there's a good chance that they are on the TRAM team. Wish them well.

Full-Span TRAM in Building 221.



ISO Internal Audits

(Continued from page 4)

By the end of September, five areas will have been audited. These areas include: CVSRF Engineering, AOI Instrumentation, VMS Maintenance, AOF Maintenance, and AO Management. Any procedures, documentation, or records that do not meet the ISO standards have been noted by the auditors as nonconforming. Nonconformances are recorded in the Corrective Action Record (CAR) System, tracked by the CAR Coordinator, and reported to management at monthly Management Review meetings.

The goal within AO is to uncover and subsequently correct all nonconformances by the end of the year. With that goal accomplished, the division should be well prepared for the pre-assessment audit scheduled for January '98, and the final certification audit in May '98. Both of these external audits will be conducted by Det Norske Veritas (DNV), the ISO registrar which has been selected by the agency and the center.

The most recent audit was conducted of AO Management, which included both branch and contractor management. The auditors were specifically looking at management responsibilities in elements 4.1, 4.3, 4.4, 4.5, and 4.18. The results include the following:

- The AO Quality Policy has not been communicated by management to every level throughout the division.

- A Customer Agreement was not signed by the Branch Chief or Test Manager, as stated in the Quality Manual procedures under 4.3.
- Records of on-the-job training are not being maintained.
- Management is not fully aware of their responsibilities for implementing the AO quality system as stated in the Quality Manual.
- Some managers are not aware of AO's corrective action system.

As with all of the internal audits, a final report will be written of the management audit by the audit team, and nonconformances recorded into the CAR system.

As the internal audits proceed, one of the lessons to be learned by all AO personnel is how to answer the auditor's questions. The next ISO article will focus on what to say to an auditor, to avoid giving uninformed answers that could lead to an unnecessary nonconformance. Until then, to prepare for an audit, know what affects you in the Quality Manual and where the documented procedures are for your work. All AO employees have the responsibility to ensure AO becomes ISO certified.



LRTA in the NFAC

(Continued from page 4)

LRTA is a wind tunnel test stand designed for testing moderate-to-large helicopter and tiltrotors up to 50,000 lb thrust and 6000 Hp. Developed jointly by NASA and the U.S. Army, the LRTA provides unique capabilities which will support both industry and government rotorcraft test programs. Some of these capabilities include a five-component balance designed for both steady and oscillatory rotor hub load determination, an instrumented flex-coupling to provide rotor torque measurements, and a control system designed to provide conventional collective and cyclic trim pitch control as well as dynamic high frequency blade pitch control up to 30 Hz.

The fabrication and initial acceptance testing of the LRTA was completed in FY95, with delivery to Ames in February, 1995. To bring the LRTA to operational status, a number of tasks remain to be completed. These include the design and fabrication of a rotor control console, rotor balance calibration, and final acceptance testing. These tasks are scheduled to be completed

Four LRTA tests 'are currently scheduled for 1999 and 2000. Although meeting this schedule will be challenging, the research payoffs are well worth it.'

within the next year to allow for a 1/99 LRTA checkout test in the 80- by 120 using strain-gaged UH-60 rotor blades. The primary objectives of this test are to verify the capabilities of the LRTA under load and checkout various subsystems used in the three research programs mentioned above.

Thus, a total of four NFAC wind tunnel entries using the LRTA are currently scheduled for 1999 and 2000. Although meeting this schedule will be challenging, the research payoffs are well worth it. The Rotorcraft Division (Code AR) is looking forward to working with Code AO to make these programs happen.

Aeronautics Design and Test Environment (ADTE)

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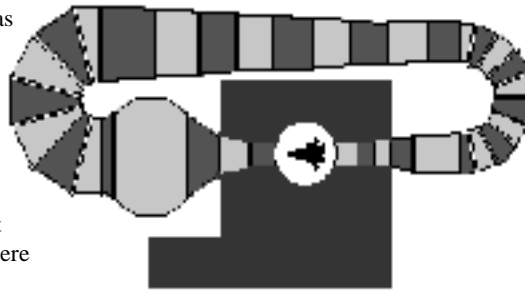
Funding constraints require ADTE to be a one year effort. Program funds came from the cancelled National Wind Tunnel Complex (NWTC). The National Wind Tunnel Complex was a joint NASA/DOD/Industry program to specify, design, and build a suite of new wind tunnels.

The new NWTC wind tunnels were to meet national needs and help the U.S. compete for business with the Europeans, who have a very good set of modern wind tunnels. A program office was established, requirements were developed, and design work initiated. NASA funded the start-up of this office through a special congressional appropriation. As the work on the design of the NWTC progressed and the cost estimates became firm, the costs were just too high and the program was cancelled. ADTE essentially received a major portion of the left-over NWTC program funds, to be spent improving NASA's wind tunnels without the huge investments required for new wind tunnels.

The ADTE program has three major goals in improving the competitive position of the US Aircraft Industry in the world aircraft market: reduce the cycle time of the wind tunnel process; extract more pertinent and accurate data from the wind tunnel environment; and change the role of the wind tunnel from passive to active in the design process. These three major

goals result in three major elements of work for the program: Wind Tunnel to Flight Data Extrapolation, Design and Test Integration, and Facility Productivity and Accuracy Enhancements.

The one year program created a tremendous workload for Ames. In order to accomplish the work, NASA and contractor personnel from the Aeronautics, Information Systems, and Center Operations Directorates are working



hard to complete the major elements of the program by the end of the current fiscal year. Because of this extraordinary time constraint, most elements in ADTE are prototype demonstrations of technologies that will be refined and implemented in all of NASA's major wind tunnels in the future. The 12-Ft. was chosen as the tunnel where the majority of ADTE deliverables will be demonstrated.

Following are some representative changes and improvements at the 12-Ft. that are now being installed and checked-out:

- 12 Ft. Productivity
 - Facility Control System Improvements and Enhancements
 - Increased rates for tunnel pressurization and blow-down
 - Increased speeds for test section rotation and personnel access
 - Work platforms for better access to the model in the test section
- 12 Ft. Instrumentation and Data
 - Automated balance calibration and simplified balance load checks
 - Automated model leveling in the test section
 - Improved pressure measuring instrumentation and protection for this instrumentation
 - Doppler Global Velocimetry -- prototype new laser velocity measuring system
 - Model deformation measurement system
 - Data system improvements and diagnostic tools
- Design and Test Tools
 - Networked capability for rapid design and fabrication of model parts
 - Connectivity between real time tunnel data and designers using computational fluid dynamics (CFD)

The results of ADTE testing will be applied to many of the important tests scheduled for the 12-Ft. in the next two years. Efforts are now underway to refine and obtain approval for a follow-on program to ADTE to maximize the benefits of this initial investment in our wind tunnels.

Orbiter Simulation Focuses on Center of Gravity

(Continued from page 1)

This entry's primary objective was to gather data for the certification for forward expansion of the orbiter center of gravity. Upcoming space station assembly flights have possibilities of requiring landings with c.g. positions two inches farther forward than the current certification. At the beginning of this study, data indicated that with the far forward c.g., the rates at slatdown of the nosegear were above limits. This caused a re-evaluation of the fidelity of the Ames simulation with the high frequency "loads" simulation at Boeing North American which was

not exceeding limits. After much discussion, the "loads" simulation updated their aerodynamic database, delivered a new aero correction for the loads, and data collection began in earnest. Preliminary results indicate the new forward c.g. can be certified for handling qualities and slatdown rates, but margins have been reduced.

Other results: it was determined that 1) the extended nose gear strut helped all vehicle mass properties without any adverse affects; 2) the flight rules for visibility should remain where they are (especially at night and with no HUD); 3) the flight rules for leaking tires are sufficient, even if

the good tire is very cold (and therefore lower pressure); and 4) large speedbrake angles are safe to fly and do not hurt handling qualities. Thirty-one members of the pilot astronaut corps received landing and rollout training.

VLab was used at Johnson Space Center (JSC) for the entire simulation and was well received by all who used it. VLab was in constant use eight hours a day for the full six weeks of the simulation. The features of VLab were especially useful during the problem solving period with the "loads" simulation, and the utility was verified when a test matrix was led from the JSC site.

Employee of the Month Awards

Doug Greaves Oversees New CGI Effort

Doug Greaves was chosen as a Civil Service Employee of the Month for July for his outstanding job in overseeing efforts to replace an obsolete Computer Generated Image (CGI) system used in the Vertical Motion Simulator. A 12 year old, 3-channel CT5A was replaced by a state of the art ESIG 4530. This effort was accomplished in an innovative and cost effective manner. The CGI system belongs to the Simulation Operations Division at Johnson Space Center JSC). Since the system is surplus to their current needs, but of immediate use to Ames, an agreement was signed to transfer this device to Ames immediately with a commitment to reimburse JSC in FY '98.

Doug is our resident technical expert on Computer Generated Image systems. He has an in-depth knowledge of both the hardware and software subsystems used in state of the art equipment. In May, he visited JSC and determined that this equipment would be ideal for the needs of the VMS. He worked with our site contractors to remove the CT5A and rework the power source for the new system. He worked to contract with the manufacturer to move the system from JSC to Ames. When the system arrived at Ames, all prep work was complete. The system was powered up and the stand-alone Acceptance Test was successfully run in two days! Doug completed the integration of the new system with the host computer and video distribution network. Currently, he is working with the operations and maintenance groups to complete the integrated system test. Doug showed strong drive and dedication, working off-hours and weekends to assure the success of this important project. (Photo unavailable.)

Jeff Dewey Supports New CGI

Jeff Dewey (Syre) was selected as a Contract Employee of the Month in July for his excellent job in supporting efforts to replace the obsolete Computer Generated Image (CGI) system used in the Vertical Motion Simulator. Jeff provided superior technical support for the maintenance of our Computer Generated Image systems in the past. He volunteered to take on the maintenance aspect of this project, and proactively ensured that the needs in that area of the project were fulfilled. He led the technicians' efforts to remove the old CT5A and verify the new CGI to be operational. He assumed added responsibilities for the video distribution tasks when the need arose, and handled these tasks in a highly effective manner. Jeff's proficiency and "can-do" attitude continue to be an asset to this project and to the VMS Simlab.

Mike Lopez Supports 80 x 120 JSF Test

Mike Lopez was chosen as a Civil Service Employee of the Month in July for his work as shift leader for the test section preparation and installation of the Lockheed/Martin #2 Joint Strike Fighter (JSF) Test in the 80 x 120. Mike's hard work and leadership skills have been vital in coordinating and carrying out all of the activities required. Lockheed is using a large (25' x 25' x 8' high) rotating groundplane for this test. Installing, accurately locating, and leveling this brand new piece of very large equipment to very tight tolerances was a difficult task. Mike came up with an innovative idea for lifting the groundplane to allow precise leveling. Mike also came up with an inexpensive and effective system for routing the high pressure air lines and cable conduits to allow smooth operation throughout the range of motion. Mike's dedication and willingness to 'get the job done' have been a great help to the JSF test team.



Mike Lopez

Abraham Seyoum Develops Unique Voltage Divider



Abraham Seyoum

with inductive coils or wire round metal resistors and capacitors. Abraham's voltage divider has been used in many facilities by himself and Code J engineers and electricians, for characterizing transients. He is currently seeking a patent for the voltage divider.

Abraham was selected as a Civil Service Employee of the Month in July for his development of a Non-Inductive Voltage Divider that has been successfully used in field tests of large electrical equipment by the Unitary Project. Abraham's unique design utilizes a combination of non-inductive resistors along with carefully selected shielded and low loss cables that eliminates signal distortion during transient voltage measurements. Abraham's design avoids problems of signal distortion that are encountered with conventional measurement equipment, which uses step down transformers



Jeff Dewey

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Employee of the Month Awards

Contractor Team Emergency Wind Tunnel Repair

Stan Fimowicz, Rudy Jaklitsch, Muhamad Suleiman, and Tom Vahle (Calspan) were given a 'Contractor Team of the month' award in August for their work on repairing the main drive circuit breaker for the 12-Ft PWT in a timely manner. These employees gave up a Sunday on short notice to come in, diagnose the problem, and recommend an innovative solution. Their solution got the tunnel running again after only a shift and a half of lost tunnel time.

***Rudy
Jaklitsch,
Tom Vahle,
Stan
Fimowicz,
and
Muhamad
Suleiman***



Contractor Team Solves Wind Tunnel Electrical Problem



Vic Ellescas and Rusty Hunt

Vic Ellescas and Rusty Hunt (Calspan) were given a 'Contractor Team of the Month' award in August for their innovative, inexpensive and effective solution to a serious, long-term electrical problem at the 12-Ft. Pressure Wind Tunnel. The original implementation of a 'soft start' capability for the cooling tower primary pumps did not function as intended. Arcing across one phase of a size 5 contactor resulted in premature failures in motor control center equipment for all three pumps within a two year period. Work-around solutions to the first two failures eliminated the need for a two-step, reduced-voltage start on those pumps. However, proper functioning of the Total Temperature Control System required that such a capacity be maintained on the third pump.

Rusty and Vic proposed that a previously unused set of contacts on another size contactor be used in parallel with the repeatedly failing set, to prevent any initial voltage spike, and to share the in-rush current. The proposed fix was explained, and as a result cables are no longer required for the other pump starters. No significant arcing has been observed in

operational service. Without Vic and Rusty's simple but clever remedy, expensive and time-consuming repairs involving bypass piping or motor control center expansion would have been required.

Ames Honor Awards

Three AO employees recently received Ames Honor Awards. John Holmberg, in AOW, received an Engineer Honor Award. Steven C. Belsley, with Logicon Syre, and Harold Reimer, with Calspan, received Honor Awards in the Contractor category. These three AO employees were nominated by their peers, and were chosen for exemplary work done at Ames. We congratulate them, and all Ames Honor Award recipients.

AO CONNECTIONS

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